Prospective comparison of two laparoscopic vessel sealing devices for minimally invasive adrenalectomy in dogs

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PROSPECTIVE COMPARISON OF TWO LAPAROSCOPIC VESSEL SEALING DEVICES FOR MINIMALLY-INVASIVE ADRENALECTOMY IN DOGS

Introduction

The advent of energy-based vessel sealing devices (VSDs) has been crucial in the development of advanced laparoscopic procedures. Laparoscopic adrenalectomy (LA) was firstly described in human medicine in 1992 and has now become the standard of care for adrenal tumors.[1] The procedure has been previously reported in veterinary literature for excision of non-invasive adrenal tumors, and it has shown promising results.[2,3,4] Reported advantages over an open technique include shorter surgical and hospitalization times, and a low morbidity rate.[5] Nonetheless, few data are available on the efficacy and safety of different VSDs used for dissection and hemostasis during LA. The aim of this study is to compare surgical outcome in a cohort of dogs undergoing LA with use of 2 VSDs based on different technologies: an ultrasonic device (Harmonic Scalpel [HS]) versus a bipolar device (EnSeal [ES]).

Materials and Methods

Dogs referred to our practice between February 2014 and June 2017 were prospectively enrolled. We included dogs with a unilateral adrenal tumor without vascular invasion into the caudal vena cava, as confirmed by preoperative CT. Dogs with distant metastasis were excluded. Signalement, clinical signs, results of hematological analyses, results of endocrinologic evaluation, location and size of the tumor were recorded. If a pheochromocytoma was suspected, phenoxybenzamine was administered preoperatively for 2-3 weeks. Dogs with hyperadrenocorticism received postoperative calcium heparin and tapering prednisone for 2 weeks.

LA was performed with dogs in sternal recumbency.[3] Three 5-mm ports were placed in the paralumbar fossa and dissection of the adrenal gland and hemostasis were achieved with either HS or ES. The excised adrenal tumors were submitted for histopathology. Variables compared between groups included: surgical time; intraoperative, perioperative (< 24 hours), and postoperative (>24 hours) complications; hospitalization time and perioperative deaths. Minimum follow-up time was 6 months.

For continuous variables, mean value and standard deviation were calculated. Since the low number of cases in each group would have precluded a significant comparison, no further statistical analysis was performed. Overall Survival time (OST) was calculated.

Results

Ten dogs were enrolled. Mean age was 11 ± 1,63 years, mean weight was 9,51 ± 3,34 Kg. There were 3 castrated males and 7 spayed females. Breeds were Beagle, Yorkshire Terrier, Pekinese, French Bouledogue, Dachshund, Maltese, Poodle and three mixed-breed. Clinical signs included polydipsia and polyuria (n=6), dysorexia, hypotension and seizures (n=3). In 2 dogs with no clinical signs, unilateral enlargement of the adrenal gland was noted during routinely abdominal ultrasound. Hematological analyses were unremarkable in 3 dogs, while revealed hepatic enzymes activity above ranges in 5 dogs, and regenerative anemia in 1 dog. Three dogs received preoperative phenoxybenzamine, and 6 dogs were treated with postoperative heparin and tapering prednisone.

Mean diameter of adrenal tumor was 25 ± 4.79 mm. Seven dogs had left adrenal tumors and 3 dogs had a right mass. Five dogs underwent LA with use of ES and 5 with HS; of the 3 right sided neoplasms, 2 were excised with HS and 1 with ES.

EnSeal Group

Mean surgical time was 86 ± 32.28 minutes. Intraoperative complications occurred in 1 of 5 dogs: minor hemorrhage from the phrenicoabdominal artery which was easily controlled with vascular clips. Perioperative complication occurred in 2 of 5 dogs, that developed fatal respiratory signs at 12 and 24 hours, respectively. In both dogs, pulmonary thromboembolism was suspected on the basis of clinical signs, hematological and radiological findings. The remaining 3 dogs were discharged. Mean hospitalization time was 4.67 ± 0.58 days. No postoperative complications were recorded. Histopathology revealed adrenocortical carcinoma in 2 cases, adrenocortical adenoma in 2 cases and pheochromocytoma in 1 case. The 2 dogs that died preoperatively had a functional adrenocortical tumor (1 carcinoma and 1 adenoma).

Harmonic Group

Mean surgical time was 97 ± 14 minutes. Intraoperative complications occurred in 4 of 5 dogs and included: major hemorrhage from branches of the renal vein in 2 dogs, visibility deterioration due to smoke production in 2 dogs, and capsule rupture in 1 dog. The 2 cases of major hemorrhage required conversion to an open approach; control of the bleeding was easily achieved after conversion and both dogs did not require supportive care for hemodynamic changes. No perioperative complications or deaths were recorded in this group. All 5 patients were discharged and mean hospitalization time was 4 ± 1 days. One dog was discharged after 5 days and developed postoperative fatal respiratory complications after 21 days. Pulmonary thromboembolism was suspected. Histopathological evaluation revealed adrenocortical carcinoma in 2 dogs, adrenocortical adenoma in 1 dog and pheochromocytoma in 2 dogs. The dog that died postoperatively had a functional cortical adenoma.

Outcome

There were no intraoperative deaths. Clinical signs resolved briefly after discharged in all dogs. At the end of the study, 6 dogs were alive without signs of recurrence. 1 dog died due to unrelated causes at 350 days; at that time, the dog was still free from disease. 3 dogs died due to suspected thromboembolism at 12 hours, 24 hours and 21 days respectively. OST was 177 days (range 0-610 days).

Discussion

Unilateral LA was successfully performed in 10 dogs with use of 2 different VSDs. VSDs offer perceivable advantages during laparoscopic surgery, as they allow for fast and reliable dissection and hemostasis without requiring accurate vessel isolation, thus reducing instrument interchange and surgical time. The development of VSDs based on different technologies has raised the question whether any instrument may offer advantages in specific surgical procedures. In human medicine, a few papers have compared efficacy and safety of various VSDs. One study suggested that bipolar VSDs may provide shorter surgical time and reduce risk of blood loss in human patients undergoing LA.[6] Similarly, in our study use of ES appeared to be correlated with shorter operating time and fewer hemorrhages compared to HS. Intraoperative complications occurred in 4 of 5 dogs in the HS group versus 1 of 5 dogs in the ES group. Intraoperative complications associated with use of HS were smoke production (n=2), capsule rupture (n=1) and major hemorrhage (n=2), which required conversion to an open approach. HS is an ultrasonic VSD which seals and cuts tissues with formation of a denatured protein coagulum. Thus, inadequate control of the blade may cause accidental damage to adjacent vessel and consequent hemorrhage. Furthermore, the vaporization of tissues determines a massive production of smoke that may preclude correct visualization of anatomical structures and prolong surgical time.

On the other hand, ES relies on bipolar energy that melts collagen and elastin in vessel wall and forms a permanent seal; dieresis is provided through a blade which is independently controlled by the surgeon. Therefore, it offers better control over vessel sealing and was correlated with lower incidence of hemorrhage. In our study, only 1 patient in the ES group developed intraoperative hemorrhage, that was rapidly controlled and didn't require conversion. However, ES produces higher temperatures and determines a greater lateral thermal spread. In our study, perioperative deaths due to thromboembolism occurred in 2 dogs in the ES group; it might be hypothesized that lateral thermal spread may damage vascular endothelium thus causing abnormal blood clotting. In the HS group, there were no perioperative deaths; nonetheless, 1 dogs died 21 days postoperatively due to respiratory complications. However, all dogs that developed fatal thromboembolism had a functional adrenocortical tumor, and it is thus difficult to determine whether this complication was correlated with VDS employed or with tumor type. [7]

Mean hospitalization time was similar for both groups; although all patients were doing clinically well 1-2 days postoperatively, it was decided to prolong hospitalization in order to provide IV therapy, especially for those receiving postoperative heparin for functional adrenocortical tumors. Results of the present study suggests that ES may be provide shorter surgical time and is more reliable in vessel dissection and hemostasis. HS, nonetheless, seems to be correlated with lower incidence of perioperative deaths.

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